EMLP2-lodgpole pine response to aspen competition

Objectives/Questions

- Develop models for estimating effects of amount of aspen on growth of lodgepole pine
  - How serious are the effects of aspen and what are threshold densities?
  - Upper foothills vs lower foothills – same?
  - What variables (and CI's) are useful for modeling competitive effects?
  - Inter vs intraspecific competition?

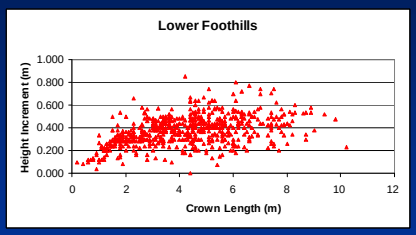
Design

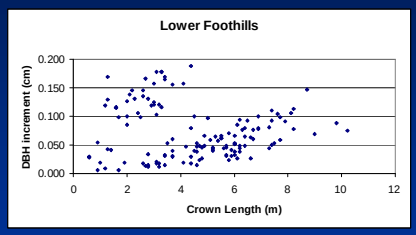
- Sampled in both lower foothills and upper foothills - 9 installations each (2006 and 2007) (Field work done by Thrower/Timberline – Darren and helpers)
  - 3 installations established in each of 3 age classes (10-20, 20-30, and 30-40)
  - 6 sample plots (9.77 m radius) in each location – across gradient from lowest to highest aspen density on site
    - 12 "SUBJECT" pine selected
    - all trees measured and location in plot mapped
      - Plot level and individual tree "neighbourhood" measurements calc.
  - In 9 installations – in 3 (of the 6) plots – Pine subject trees (and a sample of aspen) cut and cookies measured to determine diameter increment.

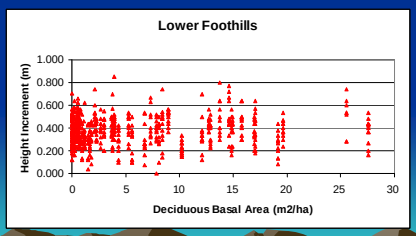
Table 1. EMLP2 Installations overview information.

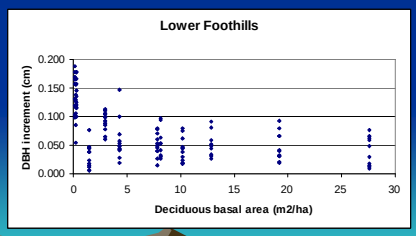
Age Class	Installation	FMA	Location	Date Measured	Natural Subregion	Ecological Description	Destructive Plots
10-20	2-008-0462	HWP	Emerson Rd km 80	15-Jan-08	LF	E 4 C	2, 4, 6
10-20	2-009-0048	HWP	Swansons South Rd km 72.5	1-Jan-08	UF	E 5 C	2, 4, 6
10-20	2-008-0443	HWP	Emerson Rd km 83	15-May-08	LF	E 5 C	
10-20	68130048	WCG	Calahoo Rd km 31	5-Jun-08 / 18-Jan-08	UF	C 5 C	2, 3, 6
10-20	S19904	CFG	4123 km RHS		UF	F 5 D	
10-20	ER 129-418	MWW	Eagle Tower Rd km 7.6	30-Jan-07	LF	C 4 C	
20-30	2-007-0598	HWP	Emerson Rd km 86	23-Jan-08	LF	D 6 B	
20-30	120	SDA	Sundance Rd km 60.1	15-Feb-08	UF	E 5 C	2, 4, 6
20-30	121	SDA	Sundance Rd km 60.3	10-Feb-08	UF	E 5 C	2, 4, 6
20-30	2-009-0060	HWP	Emerson Rd km 73	25-May-08	UF	C 3 C	
20-30	65070015	WCG	3.0 km W on Weyco Main from Bald Mtn Rd Junction	10-Jan-07	LF	C 5 C	
20-30	3-003-025A	HWP	3-3-102 Rd, 1.0 km past Erith bridge, RHS	Jan-07	LF	C 4 C	2, 4, 6
30-40	55	SDA	Sundance Rd km 61	5-Feb-08	UF	D 5 B	2, 4, 6
30-40	65070016	WCG	3.0 km W on Weyco Main from Bald Mtn Rd Junction	15-Jan-07	LF	C 4 C	
30-40	3-003-0011	HWP	Sundance Rd km 21.5, RHS 0.2 km	15-Nov-06	UF	C 4 C	
30-40	OG3-8-604	MWW	Goose km 57 (approx) 1 km SW of bridge	Feb, Mar-07	LF	F 6 D	2, 4, 6
30-40	1970	SLS	Hwy 68, S of Jumpingpound Demo Forest	Feb-07	LF	E 5 C	2, 4, 6
30-40	4-006-0682	HWP	Priest Creek Rd km	17-Jan-07	UF	D 6 B	

Results - Plot level (300 m2) data

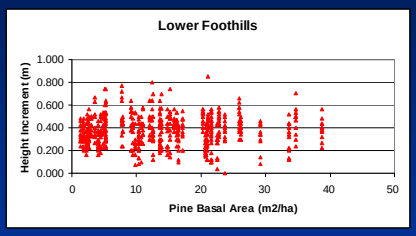


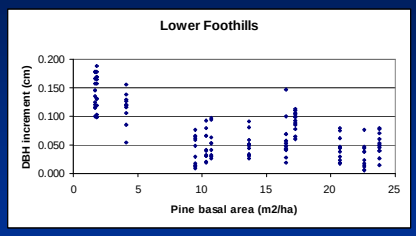


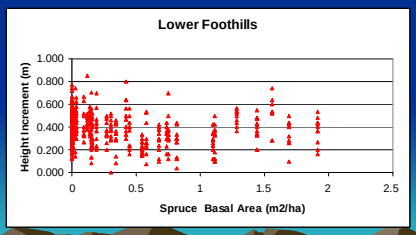


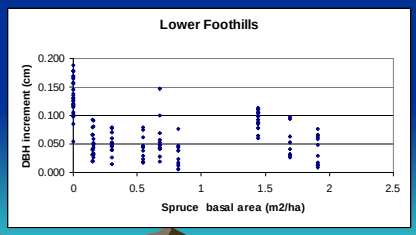


Plot level (300 m2) data

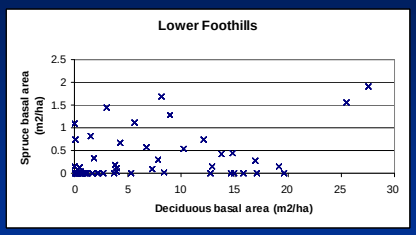


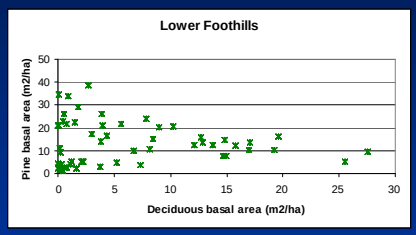






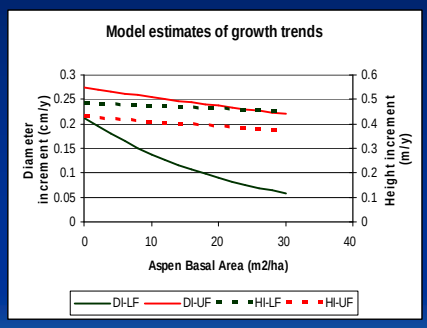
Plot level (300 m2) data

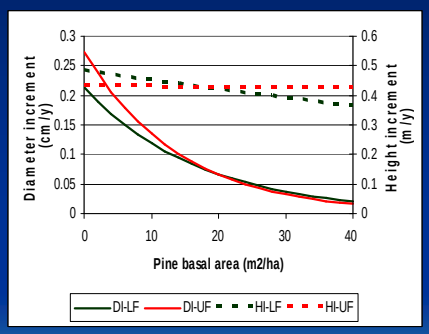




Model

$$I = a * CL^{b} * e^{(d*BAaw+f*BApl+g*BAs)}$$





Model parameter values

$$I = a * CL^{b} * e^{(d*BAaw+f*BApl+g*BAs)}$$

Parameter	Indep variable	diam incr LF	diam incr UF	ht increment LF	ht increment UF
a		0.097	0.1152	0.2493	0.2592
b	CL	0.488	0.5375	0.4119	0.3154
d	BA-Aw	-0.04319	-0.00718	-0.00244	-0.00516
f	BA-Pl	-0.05838	-0.0709	-0.00701	-0.00026
g	BA-Spruce	-0.04864	-0.399	-0.1381	-0.0305
n		138	175	626	626
R^2adj		0.752	0.471	0.309	0.33

Highlighted cells indicate where parameter values are non-significant

Comparison of Competition Indexes (9.77 m radius plot level). R^2 values
MODEL I=a * CLb*e (d*BAaw+f*BApl+g*BAs)

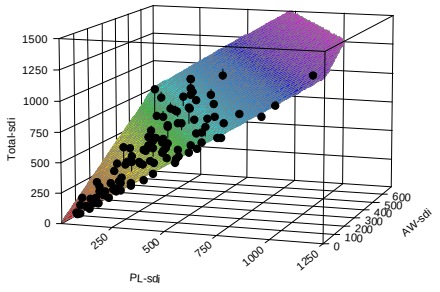
Dependent variable	**CI**	**LF**	**UF**
Height increment	TPH	0.360	0.372
	BAHA	0.309	0.330
	HR*BAHA	0.325	0.360
	SDI	0.323	0.326
	HR*SDI	0.335	0.326
	SAMPLE SIZE	626	626
Diameter increment	TPH	0.333	0.164
	BAHA	0.752	0.471
	HR*BAHA	0.675	0.455
	SDI	0.759	0.430
	HR*SDI	0.678	0.430
	SAMPLE SIZE	138	175

Comparison of Competition Indexes (3.99 m radius neighbourhood level). R^2 values
MODEL I=a * CLb*e (d*BAaw+f*BApl+g*BAs)

Dependent variable	**CI**	**LF**	**UF**
Height increment	TPH	0.204	0.388
	BAHA	0.256	0.390
	HR*BAHA	0.308	0.410
	SDI	0.252	0.389
	HR*SDI	0.307	0.408
	LORIMERS	0.283	0.393
	HEGYIS	0.236	0.391
Diameter increment	TPH	0.404	0.189
	BAHA	0.672	0.400
	HR*BAHA	0.656	0.470
	SDI	0.683	0.361
	HR*SDI	0.660	0.445
	LORIMERS	0.592	0.283
	HEGYIS	0.525	0.283

Mixture effects on site occupancy

SDItotal=12.08+1.03 SDIpl+1.07SDIaw R2adj=0.973



Plans

- Further analysis
  - Separate taller from shorter competitors (Dec., Pl, Spruce)
  - Complete comparison of competition measures (including distance dependant (Hegyis) vs independent (Lorimers')
  - Evaluate assessment plot size effects
  - Writeup
    - FRIAA report (complete April 15)
    - Paper (December 2008)
- Remeasure plots – 2010 and 2011